REMARKS

Overview

Applicants submitted an Amendment After Final Action, dated May 23, 2006. The examiner did not enter the amendment and, on June 15, 2006, he telephoned Applicants' attorney to inform her that he had performed another search in which he had identified the following references as potentially pertinent to the present application: U.S. Patent No. 6,713,377 to Lee et al. (Lee), Japanese Patent Publication No. 62172741 to Oki Electric Ind. Co. Ltd. (Oki), and U.S. Patent No. 6,911,400 to Colburn et al. (Colburn). In his advisory action, dated June 22, 2006, the examiner stated that in order to determine patentability of the pending claims, a thorough review of these references would be required, as well as a complete updated search. In the following remarks, Applicants first reply to the final Office action dated December 8, 2005, and then address the references identified in the examiner's updated search.

Summary of Interviews

The undersigned attorney thanks Examiner Smith and Examiner Malsawma for the courtesy of the telephonic interviews, which took place on March 28, 2006, April 21, 2006, June 15, 2006, and September 12, 2006. In accordance with 37 C.F.R. § 133, Applicants set forth the following information.

During the March 28 interview with Examiner Smith, claim 1 in view of U.S. Patent No. 4,090,006 to Havas et al. (Havas) and U.S. Patent No. 4,339,305 to Jones (Jones) was discussed. In particular, it was pointed out that both Havas and Jones disclose blanket deposition of a metal layer, but not selective deposition of a metal layer. It was further pointed out that there are significant advantages to be gained from selective deposition. Possible amendments to the claims were discussed.

During the follow-up April 21 interview with Examiner Malsawma, the discussion that took place during the March 28 interview was summarized. Applicants reiterated the observation that both Havas and Jones lack any description of selective deposition of a metal layer. Applicants also discussed the benefits conferred by selective, as opposed to blanket,

deposition of a metal layer. Proposed amendments to the claims, which correspond to those that are presented in the foregoing listing of claims, were discussed. Examiner Malsawma indicated his willingness to perform a search based on the amended claims and, depending on the results of the search, to enter the amendments.

During the June 15, 2006 interview, Examiner Malsawma informed Dr. Scozzafava, Applicants' attorney, that his updated search had revealed that Lee, Oki, and Colburn might be pertinent to the patentability of the pending claims. These references were discussed in the follow-up interview that took place on September 12. In that interview, Examiner Malsawma suggested that if Applicants filed a Request for Continued Examination that addressed the patentability of the pending claims over Lee, Oki, and Colburn, he would probably allow the claims. The amendments to the claims and comments provided below reflect the discussion during the examiner interviews.

Rejections Under 35 U.S.C. § 103

In the Office action dated December 8, 2005, the examiner rejected claims 1-5, 7-21 and 23-35. In response, Applicants amend claims 1, 24, and 30. Support for the amendments can be found at least in the specification at page 9, lines 3-5, page 26, lines 4-7, and in Figures 1, 2D, and 4C.

The examiner rejected claim 1 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 4,090,006 to Havas et al. (Havas) in view of U.S. Patent No. 4,339,305 to Jones (Jones). As amended, claim 1 recites "...selectively electrolessly depositing a metallic passivating layer onto the exposed conductive element, wherein discontinuous regions of stray metallic passivating material are also deposited on the protective layer..." Neither Havas nor Jones disclose selective deposition of metallic layers. Nor do they disclose the deposition of discontinuous regions of stray metallic passivating material.

Havas discloses non-selective, blanket deposition of a layer of functional metal 28 and composite working metal 34 (col. 4, lines 27-32 and col. 6, lines 41-4). As shown in Fig. 1G, Havas's metal layers 28 and 34 are evenly deposited over glass layer 20 and composite photoresist-resin layer 24/26. He does not disclose, nor does he suggest, selectively depositing a metal layer over only the exposed conductor potions of the surface.

Jones provides a similar disclosure to that of Havas, except that Jones uses electroless deposition to plate metal 24 onto conditioning material 22 (col. 4, lines 31-33). A continuous metal layer 24 is formed as shown in Fig. 4. As with Havas, Jones makes no mention of selective deposition of metal, nor does he show the formation of discontinuous regions of metallic material on the protective layer. Therefore, neither Havas nor Jones, taken separately or in combination, disclose all the elements claim 1.

In the March 28, 2006 interview, Examiner Smith suggested that it would be obvious to modify Havas to use selective deposition of a metal layer rather than blanket deposition. In order to be obvious to modify Havas to use selective deposition as opposed to blanket deposition, there has to have been some motivation within the prior art in order to carry out the modification. Applicants respectfully submit that such motivation is completely lacking.

As discussed above, both Havas and Jones disclose only methods for blanket deposition of a metal layer. Neither reference suggests that deposition could or should be carried out in any way other than by blanket deposition. Furthermore, neither reference discloses or suggests a method for depositing a metal layer that would or could result in the "selectively electrolessly depositing of a metallic passivating layer onto ... [an] exposed conductive element," as is recited in claim 1. Certainly neither reference discloses or suggests a method for depositing a metal layer that provides for deposition of "discontinuous regions of stray metallic passivating material...on the protective layer," as is also recited in claim 1.

Because the prior art (1) did not recognize any flaws with the blanket deposition of a metal layer, (2) did not recognize the desirability of selectively depositing a metal layer over exposed conductive layers, and (3) did not provide a teaching or suggestion of how to selectively deposit a metal layer, the combined teachings of Havas and Jones do not suggest the claimed invention.

In addition, the recited method takes advantage of several process improvements that arise from depositing a metallic layer selectively rather than depositing the layer indiscriminately as a blanket. First, the deposition of metal over dielectric regions that are not intended to be covered in metal can compromise the functioning of those regions since

stray metal may remain in the dielectric even after removal of the metal layer, which could cause shorting of adjacent lines. Selective deposition only on the exposed conductive element minimizes this possibility. Second, as part of the electroless deposition process, an activation layer of palladium/tin oxide is first deposited. In blanket deposition, most of the layer is subsequently removed and discarded. Since palladium is costly, there is a considerable cost advantage to selective deposition, in which the deposition of palladium is largely restricted to the regions where it is required. Third, environmental regulations that limit disposal of waste metals are easier to comply with when there is less waste. None of these advantages are presented within the prior art, and therefore, since the art discloses no appreciation of these advantages, there would be no motivation to modify the teachings of the prior art to selectively deposit a metal passivating layer onto an exposed conductive element, as required by claim 1.

The examiner rejected claims 24 and 30 under 35 U.S.C. § 103(a) as being unpatentable over U.S. 6,426,289 to Farrar (Farrar) in view of U.S. 6,479,902 to Lopatin et al. (Lopatin). Amended claims 24 & 30 recite "selectively electrolessly depositing a metallic passivating layer onto the conductive element, wherein discontinuous regions of stray metallic passivating layer are also deposited." Neither Farrar nor Lopatin disclose selective deposition of metallic layers. Nor do they disclose the deposition of discontinuous regions of stray metallic passivating material. These deficiencies were discussed above in connection with claim 1 and Havas and Jones.

Farrar discloses deposition of a plating layer 23 that is uniform and displays no discontinuities (col. 5, lines 1-2, and Fig. 9). There is no teaching or suggestion of selective deposition of metal onto an exposed conductor. Likewise, Lopatin discloses uniform deposition of a seed layer 232 of conductive material (col. 2, lines 31-34, col. 4, lines 31-32, and Fig. 3). Neither reference shows discontinuous regions of stray metal. Therefore neither Farrar nor Lopatin teach or suggest "...electrolessly selectively depositing a metallic passivating layer onto the conductive element, wherein discontinuous regions of stray metallic passivating material are also deposited on the protective layer..." as required by claims 24 and 30. Furthermore, for the reasons discussed above in connection with Havas

and Jones, it would not be obvious to modify Farrar or Lopatin to selectively electrolessly deposit a passivating metal layer, as required by the claims.

Response to the References Identified in the Examiner's Updated Search

Lee, Oki, and Colburn, the three references identified by the examiner's updated search, are discussed in turn below.

Lee appears not to disclose at least elements 2-4 of claim 1. Element 2 of claim 1 requires "selectively removing a portion of the protective layer to expose the conductive element of the substrate surface." Lee discloses three embodiments: in the first and third embodiments, naked substrate having no conducting elements is exposed when a portion of a protective layer is removed (Fig. 1D, ref. 10 and Fig 1F, step 110; Fig. 3C, ref. 10 and Fig. 3F step 308); and in the second embodiment, removal of the protective layer (Fig. 2B, ref. 132) exposes an adhesion layer (Fig. 2C, ref. 130), and not a conducting element.

Element 3 of claim 1 requires "selectively electrolessly depositing a metallic passivating layer onto the exposed conductive element, wherein discontinuous regions of stray metallic passivating material are also deposited on the protective layer." In contrast, Lee discloses a method of electroless plating of metal interconnect on a nitride barrier (col. 5, lines 52-59). It appears that Lee fails to disclose electroless deposition of a metallic passivating layer, as required by the claim. We note that a passivating layer differs from interconnect at least because the former serves to protect one layer from contamination by another, while the latter acts as an integral part of an integrated circuit pattern. In addition to their functional differences, passivating layers and interconnect lines also differ in their physical and electrical characteristics. Furthermore, Lee fails to disclose selective deposition of a passivating layer (or of a barrier layer), as required by the claim. Lee also makes no mention of the deposition of discontinuous regions of stray metallic passivating material (or metallic barrier metal).

Element 4 of claim 1 requires "removing at least a portion of the protective layer from the substrate after deposition of the metallic passivating layer, wherein the stray metallic passivating material deposited on the protective layer is also removed." In the first and third embodiments of Lee the protective layer appears to be removed (Fig. 1D and Fig.

1F, steps 110 and 112; and Fig 3C and Fig. 3F, step 308) before electroless deposition takes place (Fig. 1E and Fig. 1F, step 114; and Fig, 3D and Fig. 3F, step 312). Furthermore, as mentioned above, none of the embodiments mention deposition or removal of stray metallic passivating (or stray metallic barrier) material.

Oki apparently fails to disclose at least elements 1, 3, and 4 of claim 1. Element 1 requires "depositing a protective layer on a topographically substantially flat substrate surface comprising an exposed conductive element." By contrast, Oki appears to deposit a protective layer over a protruding conductor, (top figure on patent cover page, refs. 12 and 14) and not over a substantially topographically flat substrate surface comprising an exposed conductive element, as required by the claim. With regard to element 3, Oki deposits a Ni conducting element, i.e., metal interconnect (third figure on patent cover page, ref. 17), onto a palladium-coated conductor but appears not to teach selective deposition of a metallic passivating layer onto an exposed conductive element, as required by the claim. With regard to element 4, Oki only seems to disclose removal of a protective layer (ref. 14) before deposition of the Ni metal interconnect, but not the removal of at least a portion of the protective layer after the deposition of the metallic passivating layer, as required by the claim. The order in which these steps occur is significant, at least because removing the protective layer after metal deposition allows the substrate to remain protected during metal deposition, and also because stray regions of metal deposition may be removed after deposition.

Colburn is concerned with techniques for producing self-aligned masks that involve selectively removing components (Fig. 1, step 6; Figs. 2a, 2b, and 2c), rather than selectively depositing a metallic passivating layer onto an exposed conductive element, as required by the third element of the claim. In addition, the claim requires depositing discontinuous regions of stray metallic passivating material onto a protective layer. We were unable to find any teaching or suggestion of this in Colburn. Furthermore, the claim also requires removing stray material in a subsequent step, which is also not disclosed in Colburn.

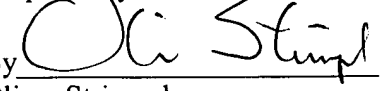
The arguments presented above for claim 1 also apply to independent claims 24 and 30, and therefore to claims 2-5, 7-21, 23, 25-29, and 31-35, which depend from claims 1, 24, and 30.

In view of the above amendments and remarks, Applicants believe that all the pending claims are patentable and that the application is therefore in condition for allowance.

Please charge any fees that may be due, or credit any overpayments, to our Deposit Account No. 08-0219.

Dated: October 23, 2006

Respectfully submitted,

By 

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